CLAIMS

WHAT IS CLAIMED IS:

1. (Currently Amended) A method for determining ~~the~~ a current distribution of an object, the method comprising: ~~by~~

measuring the magnetic fields in ~~the~~ vicinity of the object using a multi-channel measurement device that measures an ~~irrotantional~~ irrotational and sourceless vector field, whereby one measurement sensor corresponds to each channel~~, characterised in that~~;

converting a multi-channel measurement signal corresponding to each measurement sensor into ~~the~~ signals of a predetermined set of virtual sensors; and

determining the current distribution of ~~an~~ the object being measured from the signals of the set of virtual sensors in a predetermined function basis to be efficiently calculated.

2. (Currently Amended) The method ~~as defined in~~ according to claim 1, ~~characterised in that~~ wherein the object is approximated using a spherical-harmonic conductor, and a multi-pole development of the field is calculated from the multi-channel measurement signal.

3. (Currently Amended) The method ~~as defined in~~ according to claim 2, ~~characterised in that~~ wherein the multi-pole development is calculated by taking into account ~~the~~ magnetic fields outside the object.

4. (Currently Amended) The method ~~as defined in~~ according to claim 2, ~~characterised in that~~ wherein the multi-pole development is calculated by ignoring ~~the~~ magnetic fields outside the object.

5. (Currently Amended) The method ~~as defined in~~ according to claim 2, ~~characterised in that the~~ wherein external interferences are eliminated ~~using some other known interference eliminating method~~ prior to the step of converting. ~~conversion.~~

6. (Currently Amended) The method ~~as defined in~~ according to claim 2, ~~characterised in that~~ as ~~the~~ an orthonormal function basis, a current distribution equation of the following form is selected:

$$\vec{J}(\vec{r}) = \sum_{l=0}^{L} \sum_{m=-l}^{l} c_{lm} f(r) \vec{X}lm(\theta,\varphi),$$

wherein $f(r)$ is a freely selectable radial function and $\vec{X}lm(\theta,\varphi)$ is ~~so-called~~ vector spherical harmonic.

7. (Currently Amended) The method ~~as defined in~~ according to claim 4, ~~characterised in that~~ wherein:

~~the~~ an orthonormal function basis is placed into a current distribution equation; and

~~the~~ coefficients of the current distribution are analytically solved from the equation:

$$c_{lm} = \hat{\gamma}_l M_{lm} \left[\int_0^R r^l f(r) dr \right]^{-1},$$

wherein γ_l is a constant associated with order 1 and R is ~~the~~ a radius of ~~the~~ a sphere to be examined, and $\vec{X}lm(\theta,\varphi)$ is ~~so-called~~ spherical harmonic.

8. (Currently Amended) The method ~~as defined in~~ according to claim 4, ~~characterised in that~~ wherein function $f(r)$ is used to adjust ~~the~~ a depth weighing of ~~the~~ a current distribution model.

9. (Currently Amended) A measurement device for determining ~~the~~ a current distribution of an object by measuring magnetic fields in ~~the~~ vicinity of the object, the measurement device comprising:

a set of measurement channels (1, 1^1, 1^2, . . .1^n) that measure an irrotational and sourceless vector field, in which case at least one measurement sensor 2, 2^1, 2^2, . . .[[2^4]] 2^n corresponds to each channel; ~~and~~

processing means ~~(3)~~ for processing ~~the~~ a measurement signal in which the object is approximated using a spherical-symmetrical conductor, ~~characterised in that~~ wherein

the processing means include a conversion module ~~(4)~~ for converting a multi-channel measurement signal corresponding to each measurement sensor into ~~the~~ signals of a predetermined set of virtual sensors; and

calculation means ~~(5)~~ for determining the current distribution of an object being examined from the set of virtual sensors using depth *r* in a predetermined orthonormal function basis.

10. (Currently Amended) The measurement device ~~as defined in~~ according to claim 9, ~~characterised in that~~ wherein the calculation means ~~(5)~~ are arranged to calculate a multi-pole development from the multi-channel measurement signal.

11. (Currently Amended) The measurement device ~~as defined in~~ according to claim 10, ~~characterised in that~~ wherein the multi-pole development is calculated by taking into account ~~the~~ magnetic fields outside the object being measured.

12. (Currently Amended) The measurement device ~~as defined in~~ according to claim 10, ~~characterised in that~~ wherein the multi-pole development is calculated by ignoring ~~the~~ magnetic fields outside the object being measured.

13. (Currently Amended) The measurement device ~~as defined in~~ according to claim 10, ~~characterised in that~~ wherein as the orthonormal function basis, a current distribution equation with the following form is selected:

$$\vec{J}(\vec{r}) = \sum_{l=0}^{L} \sum_{m=-l}^{l} c_{lm} f(r) \vec{X}lm(\theta,\varphi) ,$$

wherein $f(r)$ is a radial function to be freely selected.

14. (Currently Amended) The measurement device ~~as defined in~~ according to claim 12, ~~characterised in that~~ wherein

the orthonormal function basis is placed into the current distribution equation; and

~~the~~ coefficients of the current distribution are solved analytically from the equation:

$$c_{lm} = \hat{\gamma}_l M_{lm} \left[\int_0^R r^l f(r) dr \right]^{-1} ,$$

wherein γ_l is a constant associated with order 1 and R is ~~the~~ a radius of ~~the~~ a sphere to be examined.

15. (Currently Amended) The measurement device ~~as defined in~~ according to claim 13, ~~characterised in that function~~ $f(r)$ is used to adjust ~~the~~ a depth weighing of a current distribution model.

16. (Currently Amended) The measurement device ~~as defined in~~ according to in claim 9, wherein the measurement device converts the signals into a set of virtual sensors prior to ~~their~~ storage, and ~~the~~ analysis software converts the stored data into a current distribution.